

Claims

- [c1] A nuclear reactor core comprising:
a plurality of fuel assemblies, each said fuel assembly comprising a lower tie plate and a main coolant flow channel comprising an inlet;
said plurality of fuel assemblies arranged into at least three regions within said core;
said flow channels configured so that the flow of coolant through said main coolant flow channels of said fuel assemblies located in a particular region are substantially the same, and that the coolant flow through said fuel assemblies in each said region is different from the coolant flow through said fuel assemblies in each other region.
- [c2] A reactor core in accordance with Claim 1 further comprising a plurality of coolant orifices, each said coolant orifice located in an inlet of a cooling flow channel.
- [c3] A reactor core in accordance with Claim 2 wherein said coolant orifices of said fuel assemblies located in a particular region are sized so that so that the flow of coolant through said main coolant flow channels of said fuel assemblies located in a particular region are substantially the same.
- [c4] A reactor core in accordance with Claim 3 wherein said coolant orifices of said fuel assemblies are sized so that the coolant flow through said fuel assemblies in each said region is different from the coolant flow through said fuel assemblies in each other region.
- [c5] A reactor core in accordance with Claim 1 wherein said core comprises a substantially circular cross section, and said fuel assemblies are arranged in an edge region located circumferentially around an outer edge of said core, a middle region located adjacent said edge region, and a central region located in the center of said core, said middle region located between said edge region and said central region.
- [c6] A reactor core in accordance with Claim 5 wherein the flow of coolant through said fuel assemblies located in said edge region is less than the flow of coolant

through said fuel assemblies located in said middle region.

- [c7] A reactor core in accordance with Claim 6 wherein the flow of coolant through said fuel assemblies located in said middle region is less than the flow of coolant through said fuel assemblies located in said central region.
- [c8] A reactor core in accordance with Claim 1 further comprising a plurality of flow restriction devices, each said flow restriction device detachably coupled to a lower end of said lower tie plate.
- [c9] A reactor core in accordance with Claim 8 wherein said flow restriction devices of said fuel assemblies located in a particular region are sized so that so that the flow of coolant through said main coolant flow channels of said fuel assemblies located in a particular region are substantially the same.
- [c10] A reactor core in accordance with Claim 9 wherein said flow restriction devices of said fuel assemblies are sized so that the coolant flow through said fuel assemblies in each said region is different from the coolant flow through said fuel assemblies in each other region.
- [c11] A reactor core in accordance with Claim 2 further comprising a plurality of flow restriction devices, each said flow restriction device detachably coupled to a lower end of said lower tie plate, said flow restriction devices of said fuel assemblies located in a particular region are sized so that so that the flow of coolant through said main coolant flow channels of said fuel assemblies located in a particular region are substantially the same.
- [c12] A reactor core in accordance with Claim 11 wherein said flow restriction devices of said fuel assemblies are sized so that the coolant flow through said fuel assemblies in each said region is different from the coolant flow through said fuel assemblies in each other region.
- [c13] A nuclear reactor core comprising:
a plurality of fuel assemblies, each said fuel assembly comprising a lower tie plate and a main coolant flow channel comprising an inlet; and
a plurality of coolant orifices, each said coolant orifice located in an inlet of a

cooling flow channel;

said plurality of fuel assemblies arranged into at least three regions within said core;

said coolant orifices sized so that the flow of coolant through said main coolant flow channels of said fuel assemblies located in a particular region are substantially the same, and that the coolant flow through said fuel assemblies in each said region is different from the coolant flow through said fuel assemblies in each other region.

[c14] A reactor core in accordance with Claim 13 wherein said core comprises a substantially circular cross section, and said fuel assemblies are arranged in an edge region located circumferentially around an outer edge of said core, a middle region located adjacent said edge region, and a central region located in the center of said core, said middle region located between said edge region and said central region.

[c15] A reactor core in accordance with Claim 14 wherein said coolant orifices are sized so the flow of coolant through said fuel assemblies located in said edge region is less than the flow of coolant through said fuel assemblies located in said middle region.

[c16] A reactor core in accordance with Claim 15 wherein said coolant orifices are sized so that the flow of coolant through said fuel assemblies located in said middle region is less than the flow of coolant through said fuel assemblies located in said central region.

[c17] A reactor core in accordance with Claim 13 further comprising a plurality of flow restriction devices, each said flow restriction device detachably coupled to a lower end of said lower tie plate, said flow restriction devices of said fuel assemblies located in a particular region are sized so that so that the flow of coolant through said main coolant flow channels of said fuel assemblies located in a particular region are substantially the same.

[c18] A nuclear reactor core comprising:
a plurality of fuel assemblies, each said fuel assembly comprising a lower tie

plate and a main coolant flow channel comprising an inlet; and
at least one of a plurality of coolant orifices and a plurality of flow restriction devices, each said coolant orifice comprising a diameter and located in an inlet of a cooling flow channel, each said restriction device detachably coupled to a lower end of said lower tie plate;
said plurality of fuel assemblies arranged into at least three regions within said core;
said diameter of said coolant orifices located in a particular region are substantially the same, and said diameter of said coolant orifices of each said region is different from said diameter of said coolant orifices in each other region;
said flow restriction devices located in a particular region are sized to be the same, and the size of said flow restriction devices of each said region is different from the size of said flow restriction devices of each other region.

[c19] A reactor core in accordance with Claim 18 wherein said core comprises a substantially circular cross section, and said fuel assemblies are arranged in an edge region located circumferentially around an outer edge of said core, a middle region located adjacent said edge region, and a central region located in the center of said core, said middle region located between said edge region and said central region.

[c20] A reactor core in accordance with Claim 19 wherein said diameter of said coolant orifices located in said edge region is less than said diameter of said coolant orifices located in said middle region.

[c21] A reactor core in accordance with Claim 20 wherein said diameter of said coolant orifices located in said middle region is less than said diameter of said coolant orifices located in said central region.

[c22] A reactor core in accordance with Claim 21 wherein said flow restriction devices of said fuel assemblies located in a particular region are sized so that the flow of coolant through said main coolant flow channels of said fuel assemblies located in a particular region are substantially the same.

[c23] A method for optimizing reactor core coolant flow distributions, the reactor core comprising a plurality of fuel assemblies arranged into at least three regions within the core, said method comprising:
adjusting the coolant flow through the fuel assemblies in a particular region to be the same; and
adjusting the coolant flow through the fuel assemblies so that the flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region.

[c24] A method in accordance with Claim 23 wherein each fuel assembly comprises a lower tie plate and a main coolant flow channel comprising an inlet and at least one of an orifice located in the inlet and a flow restriction device detachably coupled to a lower end of said lower tie plate, and adjusting the coolant flow through the fuel assemblies in a particular region to be the same comprises at least one of sizing the diameter of the orifices in each fuel assembly located in a particular region to be the same, and sizing the flow restriction devices in each fuel assembly located in a particular region to be the same.

[c25] A method in accordance with Claim 24 wherein adjusting the coolant flow through the fuel assemblies so that the flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region comprises at least one of sizing the diameter of the orifices of each region to be different than the diameter of the orifices in each other region, and sizing the flow restriction devices in each fuel assembly located in a particular region to be different than the size of the flow restriction devices in each other region.

[c26] A method in accordance with Claim 23 wherein the core comprises a substantially circular cross section, and the fuel assemblies are arranged in an edge region located circumferentially around an outer edge of the core, a middle region located adjacent the edge region, and a central region located in the center of the core, the middle region located between the edge region and the central region.

[c27] A method in accordance with Claim 26 wherein adjusting the coolant flow

through the fuel assemblies so that the flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region comprises:

adjusting the flow of coolant through the fuel assemblies located in the edge region to be less than the flow of coolant through the fuel assemblies located in the middle region; and

adjusting the flow of coolant through the fuel assemblies located in the middle region to be less than the flow of coolant through the fuel assemblies located in the central region.